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## FIXED HOG CHOLERA VIRUS.\*†

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Hog cholera is at present correctly classed as one of the invisible-virus diseases. Little has been added to the work of Dorset, Bolton and McByrde<sup>1</sup> in which they proved the specificity of the virus. Aside from knowing that it is invisible, filterable, demonstrable only by injecting suspected material into susceptible hogs, easily destroyed by heat, and unusually resistant to some of the well-known disinfectants we have no clue to its real nature. The work of Dinwiddie<sup>2</sup> presented at the 49th annual meeting of the American Veterinary Medical Association encourages the hope that the tissue-element of the red blood corpuscles of the hog may perhaps be demonstrated as the host of the specific cause.

Judging from the natural outbreaks of the disease, the variation in the virulence of virus is a very important characteristic, upon which preventive measures including the success in the immunizing and curative treatment with hog cholera serum largely depends. In preparing virus, or virulent blood, for 1,181 hyperimmune hogs, 1,964 supposedly susceptible hogs were injected subcutaneously with from two to five cubic centimeters of virus, and only 144, or 7.3 per cent, resisted infection. The 1,720, or 93.7 per cent, all developed the disease in less than 40 days.

The virus hogs were kept in regulation virus-pens—8 by 10 feet, elevated 18 inches from the ground on four legs, with waterproof metal-lined floor, slant roof, both sides solid, small narrow drop-door for ventilation in back, with door and two windows in front. Each pen is equipped with a wooden feeding trough and card holder to accommodate a card for each hog. The pens are placed in two rows of five each, from four to five feet apart. The two rows are

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† Read at the meeting of the United States Livestock Sanitary Association, December 4, 1912.

<sup>1</sup> Bureau of Animal Industry, U.S. Dept of Agriculture, *Bull. No. 72*.

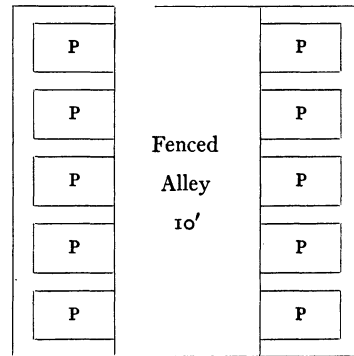
<sup>2</sup> *Report of 49th Annual Meeting of the Amer. Veter. Med. Assoc.*

separated by a fenced alley approximately 10 feet wide. The group of pens in turn is surrounded by a fence which prevents all communication from pen to pen except by the door-way of each pen.

Although 19 strains are listed in Table 1, not all of the strains were continually passed through susceptible hogs. In fact no more than six were passed through hogs in the virus-pens at any one time.

The table records 13 separate but not consecutive months. In fact a number of the strains listed were acquired several years ago, and when not passed through hogs during any one month, the "seed" of the strain was kept in sealed bulbs at a low temperature, and the month was not counted in the tabulation. A strain, passed through hogs during a number of separate

OUTLINE OF VIRUS-PEN  
INCLOSURE



but not consecutive months, was injected into not less than one lot of hogs each month and during that month the strain may have been passed through two or more hogs. Although the hogs were injected for the chief object of producing virus or virulent blood for the injection of hyperimmune hogs every effort was made to increase the virulence of the strains and to keep them pure, so that the stronger would not supplant the weaker. All the hogs for the production of virus were purchased by one who was thoroughly familiar with our needs. That they should be corn-fed and from hog-cholera-free sections of the country were chief requisites; that susceptible hogs were supplied is proved by the fact that 93.7 per cent succumb. If, as happened several times, there was reason to believe that the hogs were infected upon arrival, no "seed" was saved to carry the strain from the suspected lot.

Upon the arrival of a lot of hogs for the virus-pens, each hog was injected with from two to five cubic centimeters of the seed-virus, and placed in the virus-pen assigned to the strain. The pens were not cleaned during the time each lot of hogs was kept in them. Grain was fed twice daily and water placed in the feed troughs

TABLE 1.  
PASSAGE OF HOG-CHOLERA VIRUS THROUGH SUSCEPTIBLE HOGS.

Virus	Source	1st Month	2d Month	3d Month	4th Month	5th Month	6th Month	7th Month	8th Month	9th Month	10th Month	11th Month	12th Month	13th Month
V 1	North Dakota . . . . .	46*	29	54	49	37	11	14	9	6	...	...	...	...
		9.5†	10.9	7.7	7.5	11.5	17.8	7.6	9.7	11.3	...	...	...	...
V 2	Minnesota . . . . .	21	5	49	36	30	12	10	17	16	...	...	...	...
		7.2	8.8	9.3	5.4	7.1	7.7	7.1	10.6	6.7	...	...	...	...
V 3	Pennsylvania . . . . .	43	6	3	16	29	10	4	8	3	...	...	...	...
		19.4	4	10.3	7.2	6.5	6.4	7.2	9.3	10.3	...	...	...	...
V 4	Pennsylvania . . . . .	6	6	7	9	8	8	5	3	6	...	...	...	...
		14.4	8.6	6.4	5.9	5.5	9.2	8	6.6	5.6	...	...	...	...
V 5	North Dakota . . . . .	8	83	6	1	12	5	5	6	...	...	...	...	...
		12.1	12.2	19.5	15	9.9	6.6	11.2	7.5	...	...	...	...	...
V 6	Ohio . . . . .	6	2	18	7	2	5	5	...	...	...	...	...	...
		17.6	8.5	9.2	10.2	6.5	6.6	5.2	...	...	...	...	...	...
V 7	Pennsylvania . . . . .	4	...	...	...	...	...	...	...	...	...	...	...	...
		7.7	...	...	...	...	...	...	...	...	...	...	...	...
V 8	Minnesota . . . . .	1	9	...	...	...	...	...	...	...	...	...	...	...
		8	7.8	...	...	...	...	...	...	...	...	...	...	...
V 9	Minnesota . . . . .	51	15	...	...	...	...	...	...	...	...	...	...	...
		8	6.3	...	...	...	...	...	...	...	...	...	...	...
V 10	Minnesota . . . . .	7	...	...	...	...	...	...	...	...	...	...	...	...
		6.8	...	...	...	...	...	...	...	...	...	...	...	...
V 11	Delaware . . . . .	29	28	18	31	6	...	...	...	...	...	...	...	...
		40.1	27.1	10.3	11.2	9.4	...	...	...	...	...	...	...	...
V 12	Ohio . . . . .	5	4	...	...	...	...	...	...	...	...	...	...	...
		14.2	15	...	...	...	...	...	...	...	...	...	...	...
V 13		25	64	11	16	25	4	59	1	18	179	121	120	37
		30.1	21.2	20.5	30	36.2	12	13.4	5	19.2	11.4	20.4	14.1	21.3
V 14	Pennsylvania . . . . .	3	...	...	...	...	...	...	...	...	...	...	...	...
		22.3	...	...	...	...	...	...	...	...	...	...	...	...
V 15	Kansas . . . . .	11	58	11	...	...	...	...	...	...	...	...	...	...
		8.5	9.2	7.8	...	...	...	...	...	...	...	...	...	...
V 16	New Jersey . . . . .	15	...	...	...	...	...	...	...	...	...	...	...	...
		14.2	...	...	...	...	...	...	...	...	...	...	...	...
V 17	New Jersey . . . . .	20	...	...	...	...	...	...	...	...	...	...	...	...
		10.2	...	...	...	...	...	...	...	...	...	...	...	...
V 18	Missouri . . . . .	2	...	...	...	...	...	...	...	...	...	...	...	...
		6.5	...	...	...	...	...	...	...	...	...	...	...	...
V 19	Missouri . . . . .	6	...	...	...	...	...	...	...	...	...	...	...	...
		9.6	...	...	...	...	...	...	...	...	...	...	...	...

\* Number of susceptible hogs injected.

† Average number of days in which hogs developed hog cholera before being killed for virus or before dying.

without entering the pens. Temperatures, however, were taken and recorded daily. This was usually intrusted to one man who went from one pen to the next. Therein lies the possibility that infection was carried from one pen to the other, but a careful study of the table shows that any increase in virulence was gradual. Moreover, the care exercised in selecting the strain for "seed" reduced to a minimum the possibility that a weak strain was supplanted by a stronger.

According to the table the 19 strains had their origin in natural outbreaks in eight states. The top figures in each square opposite the number of each strain includes the number of hogs injected during each month; the lower figure gives the average number of days from the time the hog was injected until the disease had sufficiently developed for us to kill the hog for virus or virulent blood. Sudden deaths, before the hog was bled, are included as hogs killed.

With the exception of virus No. 1 the strains show a gradual increase in virulence, and we believe that we have had some of the strains under observation sufficiently long for us to regard them as having attained the maximum virulence possible. In other words, that these strains have approached or are rapidly approaching what Pasteur, working with rabies virus, called a "fixed virus." These strains are capable of producing the first symptoms—loss of appetite, occasionally reddening of the skin, and rise of temperature on the fifth or sixth day, with death on the seventh or eighth day as a direct result of subcutaneous injection in two to five cubic centimeter doses. The hogs killed in less than five days, included in the table, were probably of the small class infected before arrival.

It is interesting to note at this time that fixed rabies virus will bring about symptoms of the disease in rabbits following subdural injection on the sixth or seventh day, and death on the eighth or ninth day. The period of incubation of fixed strains of the so-called invisible viruses may be quite similar in length.

The virus or virulent blood collected from 1,720 hogs was entirely used up in hyperimmunizing 1,181 hogs of which only 6.7 per cent received one or more intraperitoneal injections and 2.7 per cent one or more subcutaneous injections. All the injections were

made intravenously except in the percentage referred to, in which cases intraperitoneal or subcutaneous injections were alone possible.

Virus propagated in the manner outlined above and injected intravenously will yield a uniformly potent serum, as has been proved by the accepted standard test which is as follows: Six susceptible pigs each weighing not less than 50 pounds are injected with doses of two cubic centimeters of virus, fixed virus being invariably used; two are then injected with 15 cubic centimeters and two with 20 cubic centimeter doses of the serum under test, and two are left untreated with serum, to serve as controls or checks on the virulence of the virus used and the susceptibility of the pigs. The virus used should kill the controls in at least 21 days while the serum should save the pigs treated.